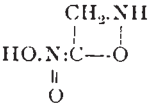
place in their educational curricula? A glance at the Time Table of any Public School, and of most Grammar Schools, or at a list of scholarships available at Universities, will show that science is the Cinderella in secondary schools, and its presence is more tolerated than encouraged. When science (rationally taught, of course) takes so many hours of a boy's school work as classics, it will be time to suggest that the languages of ancient Greece and Rome are being ousted. Father Cortie's views as to the plan and method of science teaching may be judged from the final remarks from his paper:—"Our aim in teaching science, as in teaching every other subject to the boys committed to our charge, ought to be chiefly directed to training the mind, and not to the imparting of a number of isolated and disconnected facts. I would advocate in the first place a preliminary course of classical and literary training before joining the science classes, and secondly that in the science course itself the training should be neither wholly didactic, nor yet wholly experimental, or Heuristic, to employ the term so much in fashion at present, but a judicious mixture of both. A cultured mind should be the outcome of our training, in science, as in other subjects. And for true culture, a knowledge of facts, in lieu of knowledge of principles and methods, is worthless."

SOCIETIES AND ACADEMIES.

LONDON.

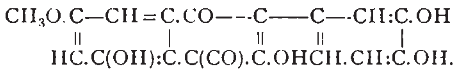
Physical Society, November 9.—Prof. A. W. Reinold, F.R.S., Vice-President, in the chair.—Dr. R. A. Lehfeldt read a paper on "Electro-motive force and osmotic pressure." This paper is an attempt to explain a difficulty in the interpretation of the ordinary logarithmic formula for the E.M.F. between a metal and solution, pointed out by the author at the Dover meeting of the British Association. An expression for the E.M.F. of a concentration cell is obtained thermo-dynamically upon the assumption that the electrolyte is only partially dissociated. A partition is used which is permeable to water but not to the salt or its ions, and the conclusion follows that the E.M.F. depends, not on the osmotic pressure of the metallic ions, but on that of the solution as a whole. A graphical representation is given plotting osmotic pressure against dilution, assuming Boyle's law to hold, and it is shown that the E.M.F. is not proportional to the integral $\int PdV$ but to the converse integral $\int VdP$. Assuming, further, that the osmotic pressure changes according to Van der Waals's equation, the E.M.F. is greater than that calculated from Boyle's Law. If the electrolytic solution pressure is calculated from the integral $\int PdV$ it comes out 10^{19} atmospheres; but if from the converse integral, the value obtained is about 20,000 atmospheres. A comparison between actual E.M.F.'s and those derived from the equation given by the author should afford, if the formula is correctly deduced from the assumptions made, a measure of how far the osmotic pressure deviates from that indicated by Boyle's law. Experiments upon concentration cells have been made by Helmholtz, Wright and Thomson, Moser, Lussana and Goodwin; but as their work was performed upon cells with migration of ions, the calculation of the osmotic pressure is rendered uncertain by the introduction of the transference ratio. Accordingly the author has measured the E.M.F.'s of cells without migration, using zinc as electrodes and chloride and sulphate of zinc as salts. The E.M.F. was measured by the compensation method, using a post office box through which a current was sent by an accumulator. The accumulator kept up a constant potential difference, and was standardised daily by means of a Clarke cell. The experimental results agree with the calculated over the range centi- to deci-normal, showing that the deviation from the value given by the logarithmic formula is accounted for by the incomplete dissociation of the salts. The osmotic pressures are then calculated from the E.M.F.'s and the values of PV plotted. They show irregularities due to the combined effect of the decreasing dissociation of the salt and the increasing departure from Boyle's Law. Dividing the product PV by Van 't Hoff's factor, determined from conductivity, values are obtained showing variations similar to those observed in the behaviour of gases when subjected to high pressure. Mr. Whetham said there was one form of membrane which is quite permeable to water and yet does not allow either salts or the ions to get through. He referred to the free surface of the solution itself. The water being volatile can get out, but the salt cannot. Dr. Donnan said the author seemed to have discovered things well known; for instance, the integral $\int VdP$ is generally taken as proportional to E.M.F. He expressed his interest in the explanation of the difficulty in the logarithmic formula. Dr. Lehfeldt, in reply, said Goodwin had used the integral $\int VdP$ but had not made any numerical calculations by means of it.—Mr. R. J. Sowter read a paper on "astigmatic lenses." An astigmatic lens is one which so acts on rays of light falling on it as to produce, in general, two focal lines in the refracted ray system. A lens derived from a quadric surface is the general elementary type of astigmatic lens, and in the paper an ellipsoidal lens is selected and considered. The focal lines are parallel to the elliptic axes, and correspond to the lens powers in these directions. These powers are proportional to the inverse squares of the axes. A curve drawn through all points on a lens where the material thickness is constant may be said to determine a natural aperture for that lens. A method of natural apertures is employed to establish the various relation set out in the paper. An ellipse is the natural aperture for an ellipsoidal lens, a circle for a spherical lens, and an infinitely long rectangle for a cylindrical lens. It is shown that two cylindrical lenses crossed at right angles are equivalent to an ellipsoidal lens, and the power of the combination in any direction is the same as that of the ellipsoidal lens in that direction. It is also shown that two obliquely crossed cylindrical lenses are equivalent to an ellipsoidal lens, or to two cylindrical lenses of definite powers crossed at right angles, or to a cylindrical and a spherical lens; for a spherical lens may be replaced by two equal cylindrical lenses crossed at right angles. Prof. S. P. Thompson said he had never seen the treatment of an ellipsoidal lens before, although the extreme case of a paraboloidal lens had been considered. The author's method was, as far as he knew, new, and would be very convenient to work with. Mr. A. Campbell then read the following papers:—(*a*) "On a phase-turning apparatus for use with electrostatic voltmeters." Electrostatic voltmeters are particularly insensitive at the lower parts of their ranges, the divisions closing in very much towards the zero point. When measurements of small direct-current potential differences have to be made, it is an easy matter to add to the voltage to be measured a constant voltage large enough to bring the deflection to an open part of the scale. If the small voltage to be measured is an alternating one, it is necessary that the auxiliary voltage should alternate with the same frequency, and be in phase with it. The apparatus described enables the phase of the auxiliary voltage to be turned until it agrees with the one to be measured. The phase difference referred to is not the time lag but the angle whose cosine is the power factor and may be called the power lag. The method is to get two independent equal voltages, U_1 and U_2, differing in power phase by $\frac{\pi}{2}$, and to add together suitable fractions of these, such as $U_1 \sin \phi$, $U_2 \cos \phi$. The resultant is equal to U_1, but with the power phase turned through ϕ. The unknown small voltage is connected in series with an auxiliary voltage and a voltmeter, and the phase of the latter voltage is turned until the maximum deflection is obtained. (*b*) "On a method of measuring power in alternating current circuits." The circuit in which the power is to be measured is connected in series across the supply circuit with a small non-inductive resistance. By means of a transformer the small voltage on this resistance may be transformed into one whose power phase is π behind the voltage on the resistance. This is added to the voltage on the circuit to be measured, and then reversed and added again. The difference of the squares of these effective resultants is shown to be equal to a constant into the power to be measured. If there is any direct current, it must be measured separately by a Weston voltmeter or other suitable instrument. (*c*) "Note on obtaining alternating currents and voltages in the same phase for fictitious loads." When testing instruments for the measurement of large amounts of electrical power or energy, it is usually desirable to do so by means of fictitious loads, or by applying to the instrument under test current and potential difference representing the required load. In order to obtain a fictitious non-inductive load with alternating currents, the potential difference and current should be in the same phase. The current for the instrument under test is got by means of a transformer worked on a hundred volt circuit. The potential difference in the same phase is got by allowing the current to flow through a non-inductive resistance and increasing the voltage at the ends of the resistance to the required amount by means of another transformer.—The Society then adjourned until November 23.

Chemical Society, November 1.—Prof. Thorpe, President, in the chair.—The following papers were read:—Action of alkalis on nitro-compounds of the paraffin series. Part 2: The reactions and constitutions of methazonic acid and the formation of isoxazoles, by W. R. Dunstan and E. Goulding. On treating nitromethane with alkalis, a mono-basic acid, methazonic acid, $C_2H_4N_2O_3$, is produced; when heated with acids or alkalis it decomposes into carbon dioxide, hydrogen cyanide, and hydroxylamine. The authors attribute the constitution



$$\begin{array}{l} \qquad\quad \mathrm{CH_2.NH} \\ \qquad\quad\ | \qquad\ \ | \\ \mathrm{HO.N{:}C{-}{-}O} \\ \qquad \| \\ \qquad \mathrm{O} \end{array}$$

to methazonic acid.—Hexachlorides of benzonitrile, benzamide and benzoic acid, by F. E. Matthews. Chlorine water in presence of light converts benzonitrile into a crystalline hexachloride, $C_6H_5Cl_6.CN$, which, when heated with sulphuric acid at 170—180°, is converted into the hexachloride of benzamide; the latter is oxidised by fuming nitric acid yielding benzoic acid hexachloride, $C_6H_5Cl_6.COOH$.—The influence of solvents on the rotation of optically active compounds, 1, by T. S. Patterson. As the result of experimental work on ethyl tartrate, the author traces the variation of rotatory power with solvent to the variation of the asymmetry of the molecule owing to changes of the internal pressure in the solution.—The action of heat on ethyl sulphuric acid, by W. Ramsay and G. Rudorf. Ethyl hydrogen sulphate yields, when heated, sulphur dioxide, carbon dioxide, carbon monoxide and ethylene, as gaseous decomposition products.—Contributions to the knowledge of fluorescent substances: (1) The nitro-derivatives of fluorescein, by J. T. Hewitt and B. W. Perkins. Anhydrous dinitrofluorescein is not fluorescent in soda solution; the authors are unable to confirm von Baeyer's analytical numbers for tetranitrofluorescein, and suggest the composition $C_{20}H_{10}(NO_2)_4O_6$ for this substance.—Derivatives of ethyl α-methyl-β-phenylcyanglutarate, by W. Carter and W. T. Lawrence. Ethyl cinnamate and ethyl sodiocyanacetate interact in alcoholic solution and, on adding methyl iodide to the product, the two stereoisomeric forms of ethyl α-methyl-β-phenyl-α-cyanglutarate are produced; derivatives of these substances are described.—The nitration of acetamino-orthophenyl acetate (diacetylorthoaminophenol). A correction, by R. Meldola and E. Wechsler.—Rhamnazin and rhamnetin, by A. G. Perkin and J. R. Allison. The authors show that rhamnazin is a methoxyrhamnetin and that rhamnetin has the following constitution:—



$$\begin{array}{l} \mathrm{CH_3O.C{-}CH{=}C.CO{-}{-}C{-}{-}C{-}{-}CH{:}C.OH} \\ \qquad\quad \| \qquad\quad | \qquad\qquad \| \qquad \| \qquad\quad | \\ \qquad \mathrm{HC.C(OH){:}C.C(CO).C.OHCH.CH{:}C.OH.} \end{array}$$

—Luteolin, 3, by A. G. Perkin and L. H. Horsfall.—Genistein, 2, by A. G. Perkin and L. H. Horsfall.—The colouring matter of the flowers of *Delphinium consolida*, by A. G. Perkin and E. J. Wilkinson. The yellow colouring matter in these flowers is present as a glucoside, and has the composition $C_{15}H_{10}C_6$; it yields phloroglucinol and *p*-hydroxybenzoic acid on fusion with potash.—Note on Gallinek's amidomethylnaphthimidazole, by R. Meldola and F. W. Streatfeild.—The amount of chlorine in rain-water collected at Cirencester, by E. Kinch.—Researches on the alkyl-substituted succinic acids: (3) Dissociation constants, by W. A. Bone and C. H. G. Sprankling. The authors have determined the dissociation constants of a number of new di-alkyl-substituted succinic acids, and show that as the mass of a normal alkyl-substituting group increases the dissociation constant also increases; in the case of 'iso' substituting radicles, however, there is a structural effect opposed to that of mass.—The reaction between ethyl alcohol and hydrochloric acid, by T. S. Price. The author has determined the velocity of reaction between ethyl alcohol and hydrochloric acid, and finds that the velocity increases very rapidly with rise of temperature.

Royal Microscopical Society, October 17.—Mr. Carruthers, F.R.S., President, in the chair.—Dr. Hebb brought before the notice of the meeting samples of stains for microscopic specimens, prepared by Messrs. Burroughs, Wellcome and Co. The stains were in a solid form, each "soloid," as they are termed, containing a definite amount of the staining reagent. The advantages of this form of preparation are simplicity and economy.—Messrs. R. and J. Beck exhibited a new pattern students' microscope. It was of the continental form, and was chiefly noticeable for its cheapness, which was attained without sacrifice of quality by adopting an improved method of manufacture. It was called the "London" microscope, and had rack and pinion coarse adjustment, perfect micrometer screw fine adjustment, vulcanite top stage, iris diaphragm in sliding tube, and spiral substage fitting.—Mr. F. W. Watson Baker gave an exhibition of slides and models illustrating the structure and development of the skin.—The Secretary announced that Mr. Millett had forwarded Part ix. of his report on the Foraminifera of the Malay Archipelago, which would be taken as read; the paper appears in the current number of the *Journal* of the Society.

Manchester.

Literary and Philosophical Society, October 16.—Prof. Horace Lamb, F.R.S., President, in the chair.—Prof. H. B. Dixon, F.R.S., gave a summary of the results of experiments, conducted by himself and Mr. F. W. Rixon, on the specific heat of gases at high temperatures. As part of a larger investigation, the authors have determined directly the specific heat of carbonic acid, up to 400° C., at constant volume. The gas is screwed up in a mild steel cylinder, which is heated in a gas-oven running on rails. The oven and cylinder can thus be brought quickly over the calorimeter, into which the cylinder falls through trap-doors forming the bottom of the oven. The transference is thus effected with a minimum loss of heat. The difficulties arising from splashing and from escape of steam are overcome by dropping the cylinder into a glass tube dipping some distance below the water. The glass tube breaks at a crack made in the neck, and thus ensures a complete immersion of the hot cylinder at a good depth in the water, which closes over the cylinder in a cataract. A similar experiment being performed with the empty cylinder, the difference gives the heating effect of the gas. The results given below for CO_2 show that the method, which, it is hoped, may yet be improved, is a workable one:

Initial temperature of gas	Final temperature	Mean	Specific heat
115	16	65·5	·200
192	16	104	·211
298	21	159·5	·288
398	21	209·5	·356

The authors are now measuring the specific heat of nitrogen in the same way.

Paris.

Academy of Sciences, November 5.—M. Maurice Lévy in the chair.—On the velocity of light, by M. Perrotin. A redetermination of the velocity of light by Fizeau's method. The distance between the two stations was nearly 12 kilometres, and the mean result of about 1500 observations by two observers was 299,900 kilometres per second.—On the latest results obtained in the study of the infra-red part of the solar spectrum, by M. S. P. Langley. The author has been able to extend his previous researches on this subject in two directions, firstly by increasing the sensibility of the bolometer, and secondly by taking the observations at a great altitude, about 13,000 feet. By reason of the remarkable purity of the atmosphere at this height, a region of the spectrum has been discovered beyond the extreme point attained by previous observers. The tables now issued contain about 600 lines, 400 of which are new. The paper is accompanied by a whole page illustration.—Remarks on the preceeding communication, by M. J. Janssen. Attention is drawn to the effect of season upon the lines observed. By working at a high altitude some telluric lines may be eliminated.—On a class of algebraic surfaces, by MM. G. Castelnuovo and F. Enriques. On the topographical correction of pendulum observations, by M. J. Collet.—Acetals of polyvalent alcohols, by M. Marcel Delépine. Determinations of the heats of combustion of the formals and acetals of glycol, erythrol and mannitol.—Constitution of the nitro-derivatives of ethyl dimethylacrylate, by MM.

L. Bouveault and A. Wahl. The nitro-derivative previously described is split up by ammonia, giving acetone and ethyl nitroacetate.—On the simultaneous presence of saccharose and gentianose in the fresh root of the gentian, by MM. Em. Bourquelot and H. Hérissey.—Note on a new glucoside extracted from the seeds of *Erysimum*, belonging to the Cruciferæ, by MM. Schlagenhauffen and Reeb. A description of the isolation, chemical and physiological properties of a new glucoside isolated from Erysimum, to which the name erysimine is given.—The distribution of the sexes in the eggs of pigeons, by M. L. Cuénot. It is shown that the view commonly held concerning the distribution of the sexes in the two eggs of the pigeon is not supported by experiment, the relations found corresponding perfectly with those calculated from the law of chances.—Contributions to the study of the phenomena of metamorphosis in the Diptera, by M. C. Vaney.—Sexual reproduction in *Ophrycystis*, by M. Louis Léger.—On the parasitism of *Ximenia americana*, by M. Edouard Heckel.—On gaseous projectiles proposed for the prevention of hail, by MM. G. Gastine and V. Vermorel.

NEW SOUTH WALES.

Linnean Society, August 29.—The President, the Hon. James Norton, in the chair.—Descriptions of some new *Araneidae* of New South Wales, by W. J. Rainbow. This paper contains descriptions of four new species, and one well-marked variety of a previously described form. Of the forms described, one is referable to the genus *Dysdera*, Latr., and is consequently a new generic record for Australia. For this species the author proposes the name *D. australiensis.* Other forms described are *Tama eucalypti*, *Araneus parvulus*, *A. singularis*, and *Dicrostichus furcatus*, Camb., var. *distinctus.*—Studies on Australian Mollusca, Part ii., by C. Hedley. Several new marine shells from Queensland and New South Wales are described, including species of *Chlamys*, *Puncturella*, *Terebra*, *Leucotina* and *Liotia.* Two plates which accompany the article illustrate these, together with species named by Tenison-Woods, Brazier and Beddome, but not before figured. The genus *Menon* published in Part i. is shown to be reducible to *Chileutomia*, Tate and Cossmann, hitherto known only as an Eocene fossil. Notes on habits, geographical range and synonymy of known forms conclude the article.—Notes to accompany figures of Boisduval's types of six species of Australian *Curculionidae*, by Arthur M. Lea. With the co-operation of Monsieur P. Lesne, of the Paris Museum, the endeavour is made to clear up matters relating to the following species:—*Cryptorrhynchus dromedarius*, *C. lithodermus*, *C. fuliginosus*, *C. ephippiger*, *Gonipterus recticulatus* and *G. notographus.* The types are in the Brussels Museum, and have been examined by M. Lesne, who has forwarded his notes and sketches.—Contributions to the morphology and development of the female urogenital organs in the *Marsupialia*, Nos. ii.-v., by Jas. P. Hill.—Descriptions of two new species of Phytophagous Hymenoptera referable to the families *Oryssidae* and *Tenthredinidae*, with notes on other saw-flies, by Gilbert Turner. A species of *Oryssus*, a genus not hitherto recorded from Australia, and one of *Clarissa* are described, both from Mackay, Q. In the same locality the author has also collected five species of *Perga*, one of *Hylotoma*, four of *Pterygophorus*, and one of *Clarissa.*—On the measurement of bacteria, by R. Greig Smith. The measurement of the breadth of bacteria by the eye-piece micrometer is uncertain because the unit of measurement (one division) is generally larger than the object measured. The author has tabulated a number of diagrammatic bacteria, the breadth of which is expressed in term of the length.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 15.

ROYAL SOCIETY, at 4.30.—Argon and its Companions: Prof. Ramsay, F.R.S., and Dr. Travers.—Data for the Problem of Evolution in Man. VI. A First Study of the Correlation of the Human Skull: Dr. Alice Lee and Prof. K. Pearson, F.R.S.—Mathematical Contributions to the Theory of Evolution. IX. On the Principle of Homotyposis and its Relation to Heredity, to the Variability of the Individual and to that of the Race. Part I. Homotyposis in the Vegetable Kingdom: Prof. K. Pearson, F.R.S.—A Chemical Study of the Phosphoric Acid and Potash Contents of the Wheat Soils of Broadbalk Field, Rothamsted: Dr. B. Dyer.

LINNEAN SOCIETY, at 8.—Contributions to the Comparative Anatomy of the Cycadaceæ: W. C. Worsdell.—On a New Parasitic Copepod: Miss Alice L. Embleton.

CHEMICAL SOCIETY, at 8.—The Bases contained in Scottish Shale Oil: F. C. Garrett and Dr. J. A. Smythe.

FRIDAY, NOVEMBER 16.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Capacity of Railway Waggons as affecting Cost of Transport: D. Twinberrow.

ANATOMICAL SOCIETY, at 4.30.—Notes on the Hair-slope in Man: Dr. Walter Kidd.—The Origin of the Vertebrate Eyes and the Meaning of the Second Pair of Cranial Nerves: Dr. W. H. Gaskell, F.R.S.

TUESDAY, NOVEMBER 20

ZOOLOGICAL SOCIETY, at 8.30.—Contributions towards a Knowledge of the Osteology of the Pigmy Whale (*Neobalaena marginata*: F. E. Beddard, F.R.S.—A Description of *Wynyardia bassiana*, a Fossil Marsupial from the Tertiary Beds of Table Cape, Tasmania: Prof. Baldwin Spencer.—On some Crustaceans from the South Pacific. Part V. Arthrostracans and Barnacles: L. A. Borradaile.—List of Mammals obtained by Dr. Donaldson Smith during his Recent Journey from Lake Rudolf to the Upper Nile: Oldfield Thomas.

ROYAL STATISTICAL SOCIETY, at 5.—On the Distribution of Population in England and Wales, and its Progress in the Period of Ninety Years, from 1801 to 1891: T. A. Welton.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Paper to be further discussed*: The Metropolitan Terminus of the Great Central Railway: G. A. Hobson and E. Wragge.—*Paper to be read, time permitting*: Machinery for the Manufacture of Smokeless Powder: Oscar Guttmann.

WEDNESDAY, NOVEMBER 21.

SOCIETY OF ARTS, at 8.—Opening Address of the 147th Session, by Sir John Evans, K.C.B., F.R.S.

GEOLOGICAL SOCIETY, at 8.—On a Monchiquite from Mount Girnar, Junagarh (Kathiawar): Dr. J. W. Evans.—On some Altered Tufaceous Rhyolitic Rocks from Dufton Pike (Westmorland): Frank Rutley.—On the Geology of Mynydd y Garn (Anglesea): C. A. Matley.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—An Improved Mounting for the Lens and Bowl of the Campbell-Stokes Sunshine Recorder: Richard H. Curtis.—Weekly Death Rate and Temperature Curves, 1890-1899: W. H. Dines.—Seasonal Rainfall of the British Islands: Henry Mellish.

ROYAL MICROSCOPICAL SOCIETY, at 7.30.—Exhibition of Slides illustrating the Structure of Shells.

ENTOMOLOGICAL SOCIETY, at 8

THURSDAY, NOVEMBER 22.

ROYAL SOCIETY, at 4.30.—*Probable* papers: Further Note on the Spectrum of Silicium: Sir N. Lockyer, F.R.S.—On Solar Changes of Temperature and Variations in Rainfall in the Region Surrounding the Indian Ocean: Sir N. Lockyer, F.R.S., and Dr. W. J. S. Lockyer.—The Histology of the Cell Wall, with Special Reference to the Mode of Connection of Cells: W. Gardiner, F.R.S., and A. W. Hill. Part I. The Distribution and Character of "Connecting Threads" in the Tissues of *Pinus sylvestris* and other Allied Species: A. W. Hill.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Telegraphs and Telephones at the Paris Exhibition, 1900: John Gavey.

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